originally suggested by H. W. Bates; a variety of changes which occur are explained by this theory and by no other yet propounded. Local changes may be explained in many ways; but that they should invariably be in the direction of a superficial resemblance to one butterfly, and that one a specially defined species, is only to be explained by the theory of mimicry. Although much support has been afforded to this theory since Bates propounded it in 1862, Col. Swinhoe states that no evidence is so complete and convincing as that supplied by the genus Hypolimnas. If we are right in believing that the results are determined by the range and abundance of mimetic forms, it is clear that selection, rather than unguided variation, is the essential cause of the phenomena.—*Journ. Royal Microscop. Society.*

Remarkable Vitality.—Early in September, 1896 I collected two forms of life from Great Salt Lake, one was the brine shrimp *Artemia fertilis*, the other the larva of a fly, the *Ephydra gracilis.*

After keeping these in salt water for ten days I washed them in fresh water, and then placed them in a small vial *filled* with a 3 per cent. solution of formaline.

After they had been in this solution for ten days I had occasion to examine them, and on taking them from the vial I found that three of the Ephydras were still living and active. The vitality of the Ephydra seems to be fully equaled by the vitality of the *Stenophelmatus fasciatus* order Orthoptera. Some fragments of this insect were sent to the University of Utah for identification. Among the fragments was the prothorax bearing the head. This piece lived for nine days, and during that time when ever it was irritated would attempt to bite with its powerful jaws. It would also turn over into its natural position when placed on its back.—C. A. WHITING.

EMBRYOLOGY.[1]

Two animals from one egg.—To the many known cases in which two animals may be obtained from one egg by experimental interference, may now be added the amphibian *Triton cristatus.* By the aid of a simple piece of apparatus Amedeo Herlitzka[2] succeeded in

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] Archiv f. Entwicklungsmechanik. IV, März 2, 1897, pps. 624–654, pl. 27.

isolating the first two cells of the egg and ultimately obtained from each cell a perfect, symmetrical, free swimming larva.

Contrary to what has often been stated for the result of similar experiments upon other animals these larvæ are not half the normal size, though each arises from half an egg.

Each larva is larger than half a normal larva. There are also certain remarkable facts concerning the size of the organs and the number of cells in these half-egg larvæ. Thus while the intestine and the muscle segments appear on transverse section much smaller than in the normal larva, the medulla and the notochord are *equal* in transverse section to the normal. In the medulla and in the muscle segments the nuclei have the same size in the half-egg larvæ as in the whole egg larvæ.

The number of cells seen in cross section is half as great in the muscle segments of the half-egg larva while the number of cells in the medulla is the *same* in the half-egg larva as in the whole-egg larva!

It seems that certain structures may be formed with less than the normal number of cells while others have the normal number.

Do the Astral Rays pull or push?—Ludwig Rhumbler[3] concludes that the radiations often seen as star-like figures during cell division are probably lines of pulling or drawing and not lines of extension or pushing. He thinks the only adequate explanation of cell division is one based upon Bütschlis' theory of the foam-like structure of protoplasm and in deciding in favor of a contractile rather than an expansive action along the astral rays he thinks he brings support to the foam theory of protoplasm.

In a previous paper[4] he began the first of a series of attempts to explain cell division upon a physical basis; he assumed a vesicular or foam-like structure for protoplasm and also certain chemical changes in the centrosomes leading to periods of great absorbtion of liquid. The withdrawal of liquid from the vesicles round about leads to tensions and, if rapid enough, to the appearance of radiating lines of vesicles. Based then chiefly upon phenomena of surface tension in the constitutent vesicles of protoplasm, each a viscid bag with more liquid contents, this hypothesis seeks to reduce all the complexities of cell division to a very few physical laws.

The present paper gives a few noteworthy figures of sections of snail's eggs showing a marked vacuolated or vesicular appearance in the pro-

[3] Archiv f. Entwicklungsmechanik. IV, März 2, 1897, pps. 659–725. Pl. 28.

[4] See AMERICAN NATURALIST for January, 1897, p. 84–6.

toplasm around the centrosome and also representing the astral radiations not as mere lines but as flat ribbons or plates. In the author's mind this means that the rays are not muscle-like fibrils, but the fused walls of alveoli or vesicles—hence their flat appearance.

The main part of the paper is taken up with the consideration of certain interesting experiments devised to illustrate the action of a set of contractile elements. Modifying the model of Heidenhain the author constructed a schema to illustrate cell division as follows: a circle of rubber tubing is made more or less rigid by steel rods inserted inside it or by means of a spiral spring—this represents the periphery of a cell; from the periphery to the center are stretched elastic bands of rubber which represent the astral rays; these are attached to two masses (forming the hub in this wheel) which may be at the centre or separated like the foci of an ellipse, when they represents the two centrosomes. According as the rim of the wheel is stiff or limp and the halves of the hub united or apart and according to the strength of the radiating bands various forms will be assumed by the system when at rest. By this scheme the author makes clear that a system of radiating contractile elements in conjunction with a somewhat resistant periphery can make various diagrams that show resemblances to phases of cell division in the behavior of the cell periphery, the length of the astral rays and the movements and positions of the centrosomes.

Besides emphasizing the part played by the cell periphery the author, by ingenious contrivances, estimates the amount that this periphery must grow or enlarge during cell division and here again seeks to bring in the assumed nuclear loss of liquid as a factor in the new formation of cell surface.

Though in the main adopting much of the conception of Heidenhain as to the part played by a system of contractile elements, the author does not suppose these elements are persistent cell structures handed on from one cell to another to do the work of cell division. Moreover he does not regard such radiations, when they are present, as anything like muscle fibrils but merely as indications of a rapid extraction of liquid leading to linear arrangements of vesicles and indicating lines of pulling force.

Continuity of Cells in Eggs.—August Hammar of Upsala having previously found[5] that the cells of cleaving eggs of echinoderms are connected by a superficial film of material, presumably protoplasm, has extended his observation and now claims that such intercellular con-

[5] See AMERICAN NATURALIST, July, 1896, p. 597.

nections are of universal occurrence. In the present paper[6] he describes and figures thin lines connecting the outer ends of *all* the cells of the cleavage and blastula stages of eggs from the following groups; Cœlenterates; Annelids; Mollusca; Tunicates; Mammals; Arthropods.

In life each cells has a faint outer periphery that is clearer than the rest; but it is only in sections that this layer, now seen as a stained line, passes over from one cell to the next so that the outermost contour of the entire egg is one continuous line of material.

In his method of preparation the cells split apart save for this peripheral line which thus becomes evident.

The author assumes that this connecting membrane is protoplasm, but it is unfortunate that he has no observations on living material to support this important claim and considering the remarkable effects often brought about by fixatives the question as to the true nature of this intercellular communication may well remain an open one. But the possibility that these connections may prove to be of similar nature to those described in the "spinning" of echinoderm eggs (AMERICAN NATURALIST, March, 1897) seems to the reviewer to add much to the probability that they are actual connections in the living egg.

From the author's point of view the blastula is one mass of protoplasm with a hole in the centre of it. He also points out the importance of the surface connection as a mechanical band; in fact he would ascribe to this many of the effects often attributed to surface tension of the individual cells. But regarding the connection as protoplasmic he emphasizes its importance as a *living* band and indicates its value as a basis for some of the assumptions of experimental embryologists as well as for the criticism of the cell theory by Whitman and by Sedgwick.

PSYCHOLOGY.[7]

Notes on Child Psychology—*Some Recent Literature.*—The past year has been one of remarkable activity in the sphere of Child Psychology everywhere, but especially in this country. *The Child-Study Monthly*, which was started in 1895, has published several articles of real value to the scientific investigator. The *Pedagogical Seminary* has been established upon a firmer footing. *Education*, *The Inland Educator*, *The Northwestern Journal of Education*, and other

[6] Archiv f. Mik. Anat. März 4, 1897, pps. 92–102, pl. 6.

[7] Edited by H. C. Warren, Princeton University, Princeton, N. J.